Utilizing Large Integrated Data Sets for Regional Seismic Research in Asia

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Introduction

- Large amounts of seismic data are currently being collected and generated at a rate of approximately 3.3 Gbytes/year.

- Several organizations (e.g., IRIS, USGS) provide a means of easily gathering open source data.

- To utilize these data effectively for regional seismic research, a mechanism must be in place that allows easy access and usage for a researcher and efficiently stores and integrates large amounts of information and data.

- LANL has developed a seismic research database that meets these requirements and provides a foundation for regional seismic research in Asia.

- The seismic research database has been used for developing monitoring technologies, including discrimination techniques, travel-time correction information, magnitude calibration.

- The seismic research database has also been used for other applications, including earthquake source studies and aftershock relocations.

Variety of Data Sets

Earthquake Catalog and Station Data
USGS catalog events in Asia have been integrated with station information and digital waveform data
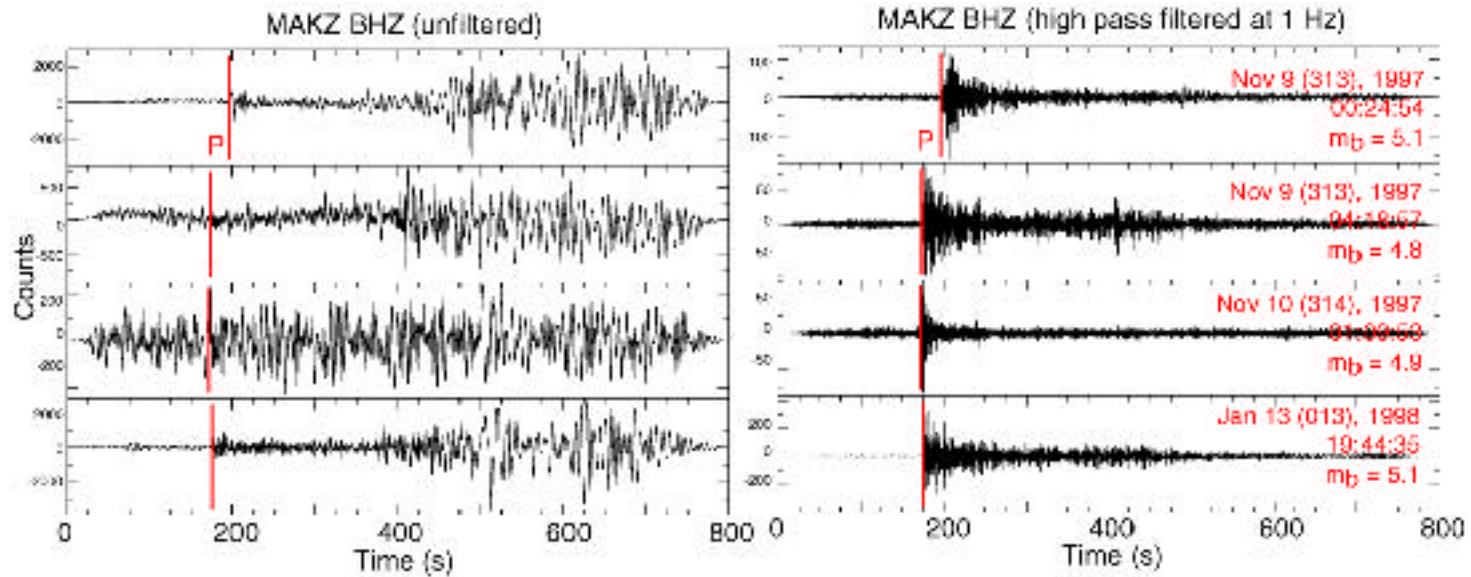
Digital Waveform Data
Example regional waveforms and arrival time for aftershocks of the 1997 Tibet earthquake
(Mw = 7.5) that are integrated with catalog and station information

# Efficient Storage of Large Integrated Data Sets

Relational Databases

An analyst picks arrival times on a waveform.

Each arrival time is assigned a unique ARID (ARrival IDentifier).

A unique WFID (WaveForm IDentifier) is assigned to each waveform.

For example, there is a unique waveform associated with this event recorded by the vertical component (Z) of the broadband channel (BH) at station WMQ.

A unique ORID (ORigin IDentifier) is assigned to an event location.
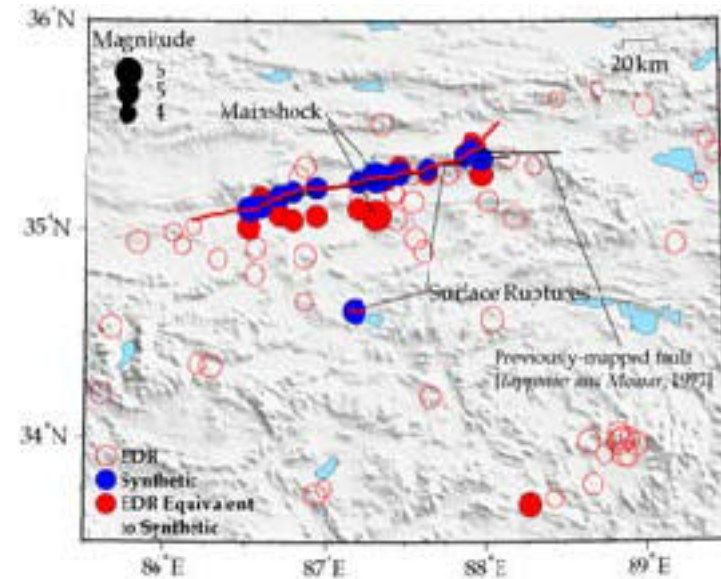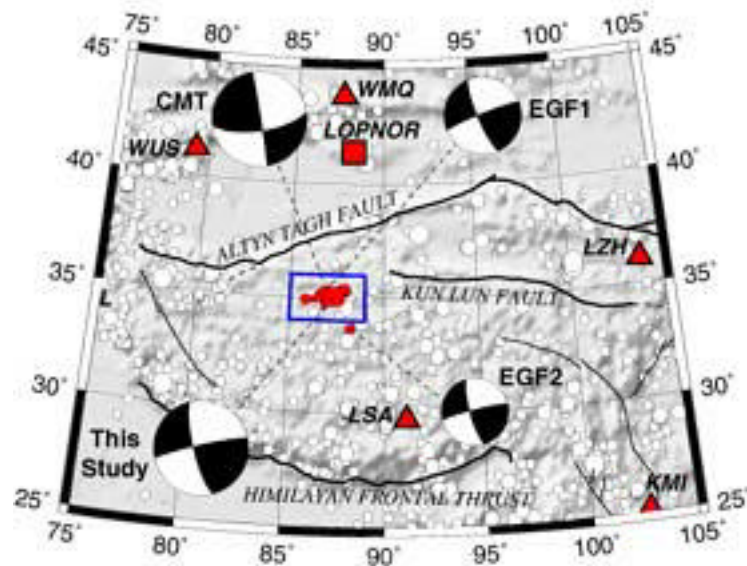There can be many ORIDs (i.e. locations) associated with an event
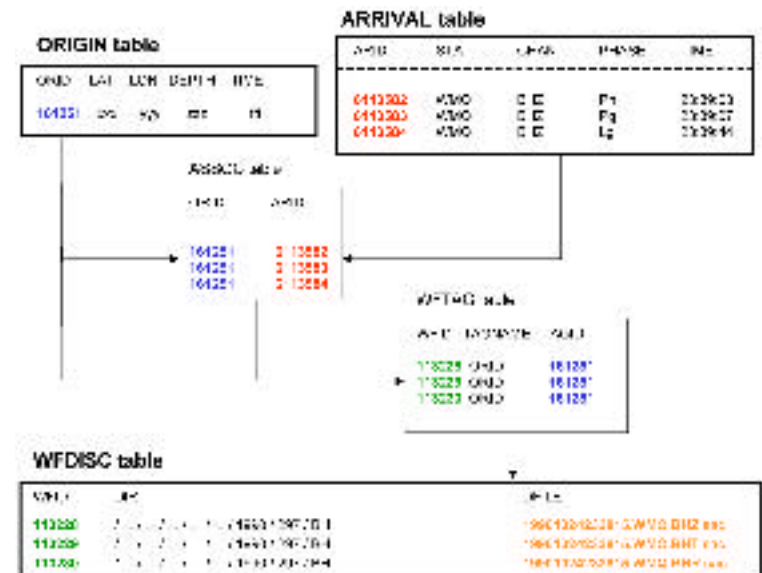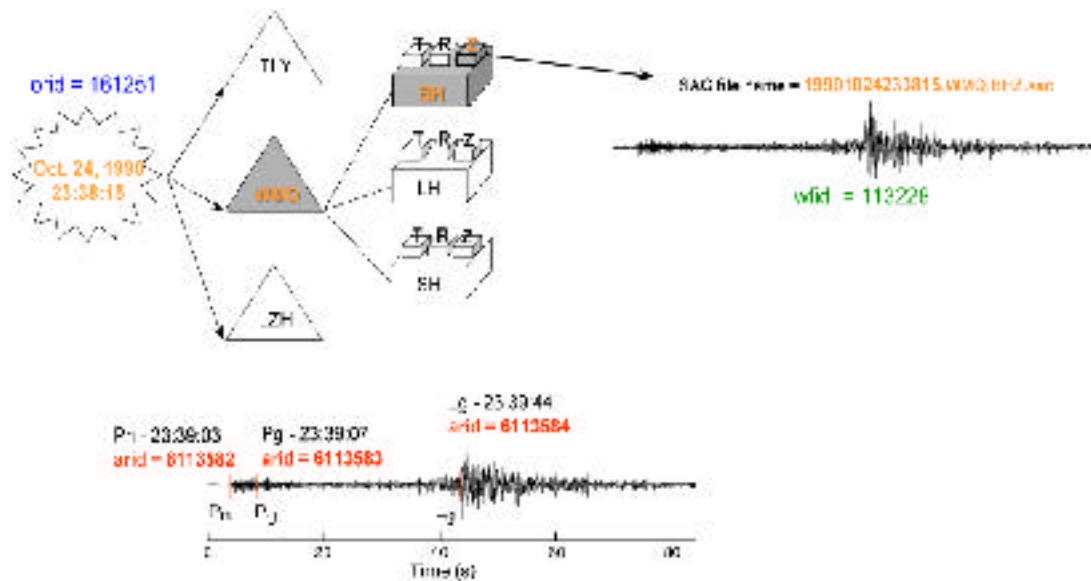
Earthquake Source Studies
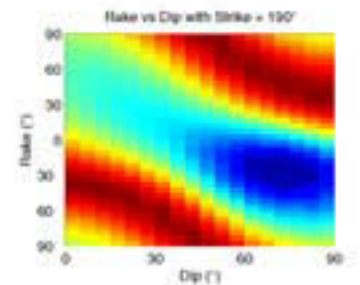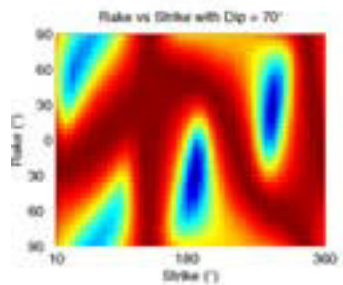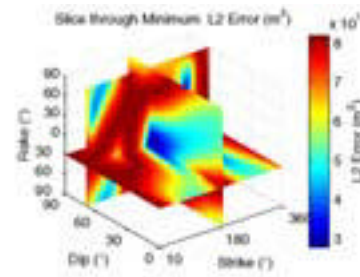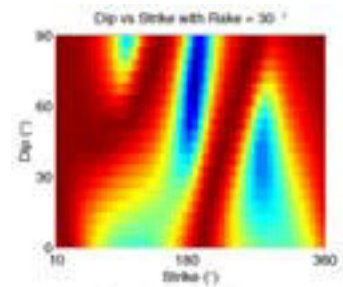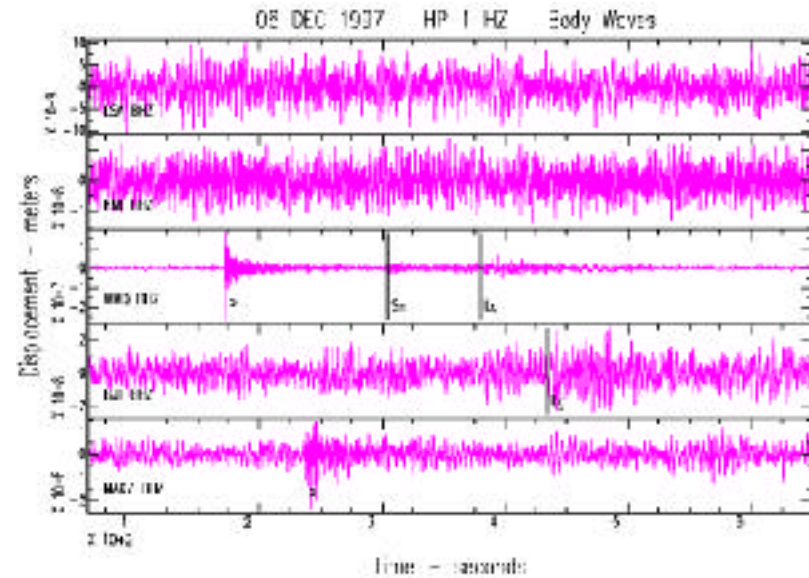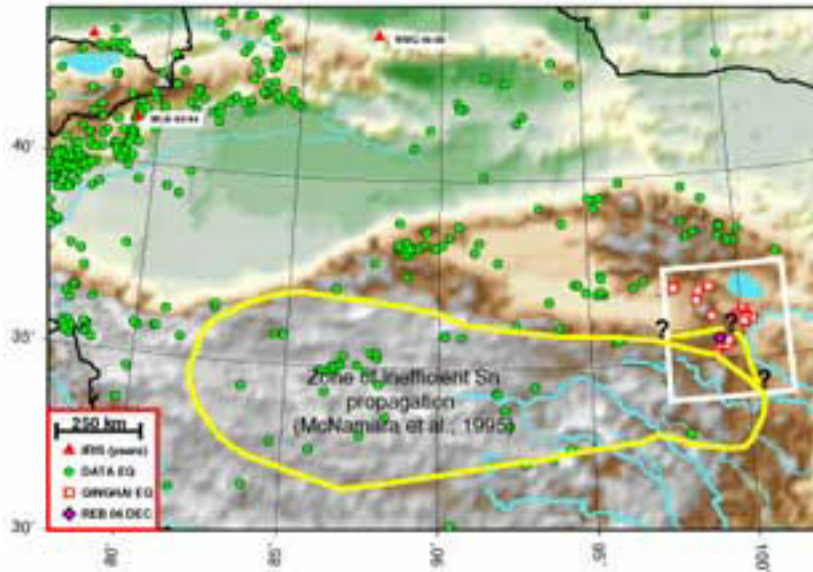
A review of regional seismic data revealed an "explosion-like" event occurred in the Qinghai Province
A grid-search for depth and focal mechanism revealed a 20 km source depth and a double couple
solution (Hartse and Velasco, 2000)

Earthquake Relocation Studies

The 1997 Tibet earthquake (Mw = 7.5) was investigated using a teleseismic data set (Velasco et al., 2000)

Event Discrimination Studies Aftershock relocations must include regional data, which is integrated with the regional research database (Begnaud et al., 2000)
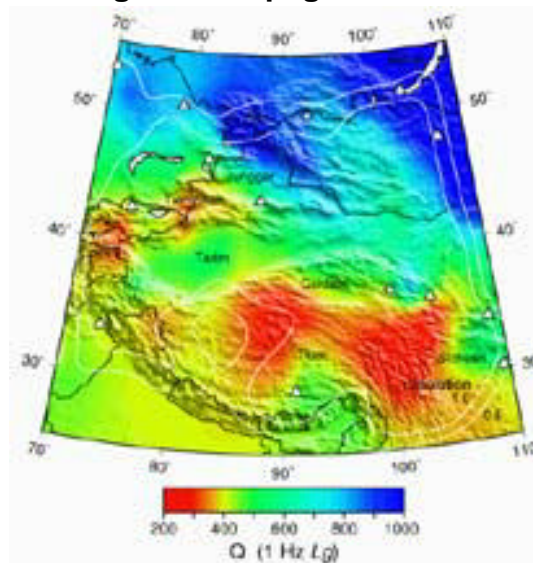
Regional Monitoring Research
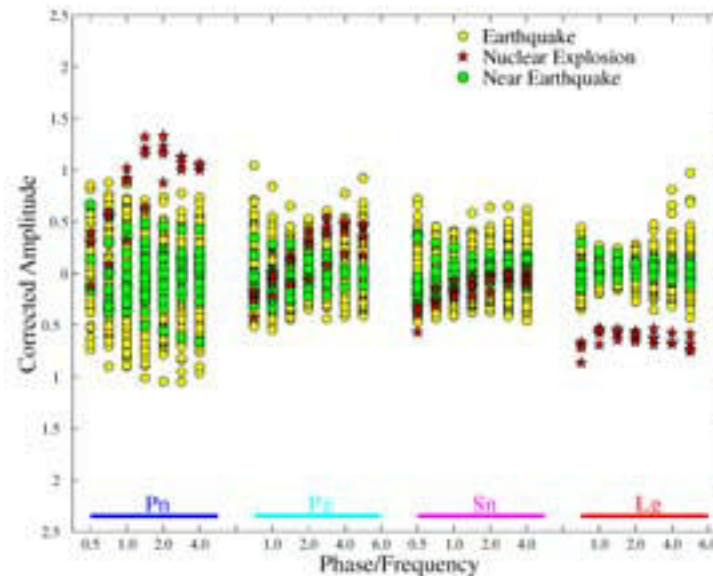## Special Event Studies
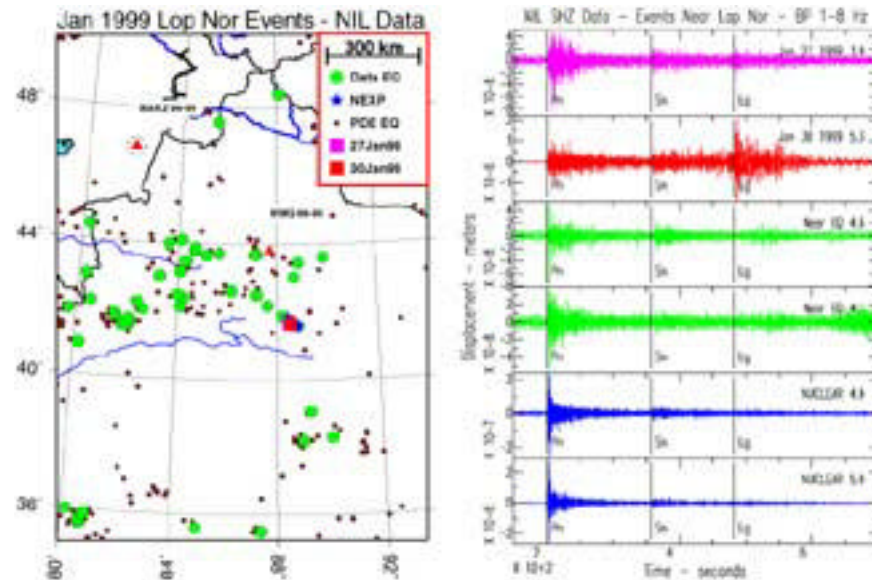
Earthquakes that occur near nuclear test sites can be compared quickly and studied with other events within the database.

Regional Propagation Studies

Propagation studies, such as Q tomography were developed using amplitudes derived from waveforms (Phillips et al., 2000).

Event Discrimination Studies

Magnitude and Distance Amplitude Corrections (MDAC) parameters for regional seismic stations were developed utilizing amplitude measurements taken from waveforms within the database (Taylor et al., 1999).

Summary

• Databases help integrate large data sets, allow for easy access and usage for a researcher, and efficiently store and integrate a wide variety of information and data.

• Utilizing large integrated data sets can support a wide variety of regional seismic research topics.

• This is just a sample of the research that is being accomplished with this regional seismic database.

For more information, view our "Technical Documents" section at http://www.ees3.lanl.gov.